The Space Congress® Proceedings

2007 Space Visions Congress - Growing the Next Generation of Scientists and Engineers

Apr 27th, 4:30 PM

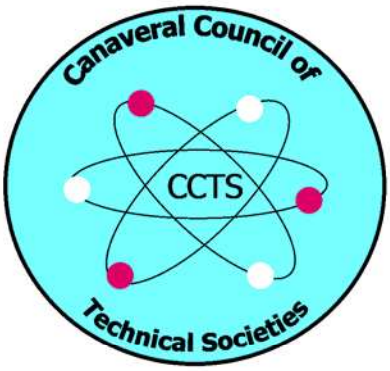
Speaker on Eliminating the Prohibitive Launch Costs of Solar Power Satellites

Gene Meyers

SPACE VISIONS CONGRESS 2007

FRIDAY EVENING SPEAKER ONE

GENE MEYERS



Abstract

Eliminating the Prohibitive Launch Costs of Solar Power Satellites

Worldwide wholesale electricity sales now total $2 trillion each year. That's several orders of magnitude higher than communications satellites. Electricity sales will grow to $10 trillion by 2050, but the industry is under tremendous environmental pressure.

For 40 years, NASA-designed solar power satellites have been proposed as the ultimate, worldwide energy source. Orbiting at 23.000 miles these mile-wide sheets of solar cells could deliver clean energy 24/7 to any location on Earth via safe, very weak microwave beams.

Based on the manufacturing cost of mass-produced solar sat components alone, this energy should be competitively priced. But launching those components to this orbit increases those costs 10-fold.

The Space Island Group, inc. will virtually eliminate those launch costs by leaving the fuel tanks and cargo pods of their shuttle-derived launchers in orbit when empty, converting their interiors onto living quarters, labs and factories, then leasing them to a wide range of non-energy clients. They are now negotiating a $200 billion, 15-year energy contract with the governments of India and China.

This portion of the panel will present an overview of their cost/revenues and station tenant base. It will also outline the dramatic economic effect these very high volume, Florida-launched vehicles will have on the region, including industries built around the new space-made materials that will be brought back.

Details at; www.spaceislandgroup.com

Contact; Gene Meyers, CEO spaceislandgroup@verizon.net

The Space Island Group's

Development of Commercial Space Infrastructure &
$200 Billion Solar Satellite Project

Financial, Technical & Project Timeline Overview

Prepared Especially For
The Space Vision Congress
Orlando, Florida
April 27-28, 2007

Project Overview

- The scale of this project is several orders of magnitude greater than any commercial space endeavor now under development
- It will require a start-up funding commitment of at least $10 billion from non-government sources in 2007-2008
- It will generate annual sales of $10 billion by 2012 and $100 billion by 2020
- It will employ a workforce larger than NASA's early in the next decade
- Although it will require no U.S. Government funding, it could reduce the cost of NASA's Moon/Mars program by half
- This presentation outlines how these goals are being achieved

Funding & Revenues

- The Space Island Group's (SIG) start-up and ongoing revenues will come from 2 separate but related sources
- The first is the worldwide sale of environmentally clean, competitively-priced energy from solar power satellites
- This market is providing the $10 billion start-up funding
- The second is a wide range of commercial activities conducted onboard SIG's space stations
- These stations will be built by converting the interiors of the fuel tanks and cargo pods of SIG's shuttle-derived launchers into habitats in orbit

The Space Island Energy Market

Electricity generation and transmission is a $2 trillion industry worldwide that will double over the next 20 years

- Communication satellites are by comparison a $100 billion industry that will remain static
- Worldwide demand for environmentally clean energy generation is growing every day
- Wireless power transmission from GEO is the only non-nuclear, non-fossil fuel, 24/7/365 option available worldwide to meet this goal, but only if its price is competitive
- SIG's researchers have set that competitive price at 10 cents per kilowatt hour, measured at the receiving antennas on the ground

Solar Satellite Designs

Solar power satellite designs have been studied by NASA, other space agencies and universities for nearly 40 years. The major components requires are;

- Solar cells or thermo-mechanical devices to convert sunlight into electricity in orbit
- Devices to convert the electricity into microwave beams to be transmitted to receiving antennas on the Earth below
- Command and control devices to control the satellite's orientation
- Antennas on the Earth to receive the beams and convert them into usable electricity

Financial & Operation Considerations

- To profitable achieve SIG's price goal of 10 cents per kilowatt-hour, the following criteria much be met
- The combined manufacturing cost of all the solar satellite components in orbit much not exceed $3,000 per kilowatt delivered to the ground
- Efficiencies of solar conversion devices must be at least 30% (Efficiencies of over 40% have been achieved in labs)
- Microwave transmission efficiencies from orbit must be at least 50% (Efficiencies of over 80% have been achieved in labs)

Transmission Considerations & Costs

- Virtually all of the solar satellite components needed by SIG are now in production for military or communications satellites
- SIG's mile-wide, 1,000 megawatt solar satellite and mile-wide receiving antennas will require component production rates 100 to 1,000 times greater than today's rates
- SIG will provide $1 billion from its $10 billion start-up fund to redesign these components for mass production
- Extensive discussions with potential suppliers indicate that SIG's goal of $3,000 per kilowatt will be achievable with its $1 billion investment and these higher production rates

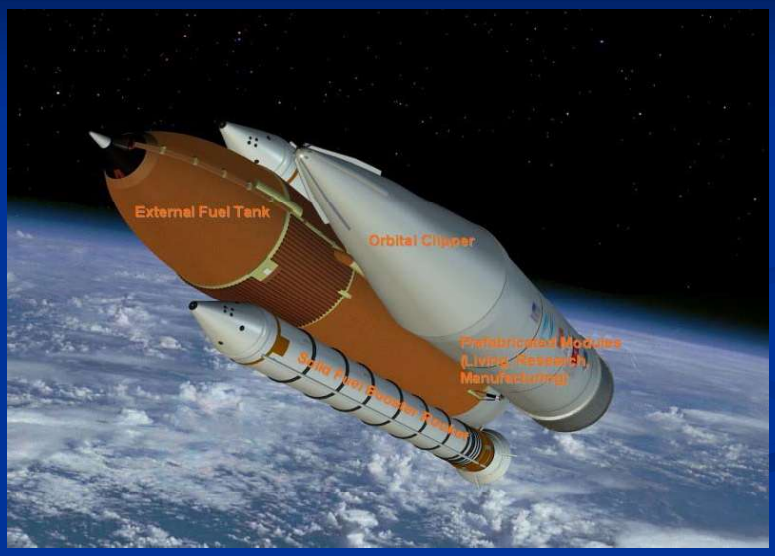
$10 Billion Start-Up Funding From Solar Satellite Energy Buyers

- Based on the above solar satellite weight and efficiency goals and SIG's launch capabilities described below SIG calculates that it will beam 2 trillion kilowatt-hours of energy down to Earth between 2012 and 2025, which will be sold at 10 cents per kilowatt-hour
- Discussions are now underway with the Governments of India, China and other to issue a $200 billion advance purchase order to buy all of this energy from SIG
- The World Bank and other International Institutions are willing to arrange a $10 billion advance to SIG against this purchase order
- This advance financing arrangement is standard procedure for funding energy facilities around the World

SIG's Shuttle-Derived Launch Vehicle

- This vehicle will incorporate modified version of engines, external fuel tanks and boosters which NASA developed and flight-tested for their space shuttle program
- Its personnel-carrying component will be derived from the Delta Clipper (DC-X) single-stage-to-orbit vehicle which was prototyped and tested in the 1990s
- Variations of the COTS-ISS supply vehicles now under development may also be used
- The vehicle will incorporate design concepts from NASA's Skylab space station and the ISS

Space Island Launch Vehicle

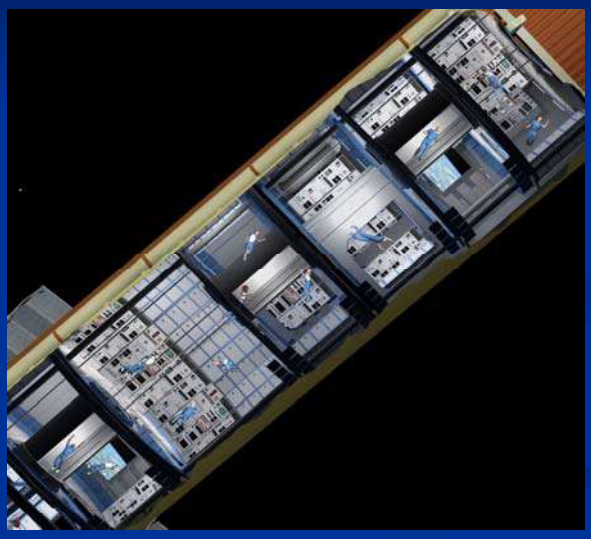


- If the side-mounted fuel tank shell carries cargo, its capacity will be 100,000 pounds with the 30-passenger DC-X above it
- If the DC-X is replaced by a cargo faring the capacity will be 180,000 to 200,000 pounds
- Both the cargo-carrying shell and the larger, fuel filled-tank will remain in orbit when empty for conversion into living quarters

- SIG will fund the development of 5-segment boosters and a stretched, 180-foot long fuel tank for this vehicle based on ATK's proposals
- SIG's funding could reduce NASA's cost of these components for their Moon/Mars project
- The very large production runs of SIG's launch components could also reduce the cost of NASA's engines and fuel tanks

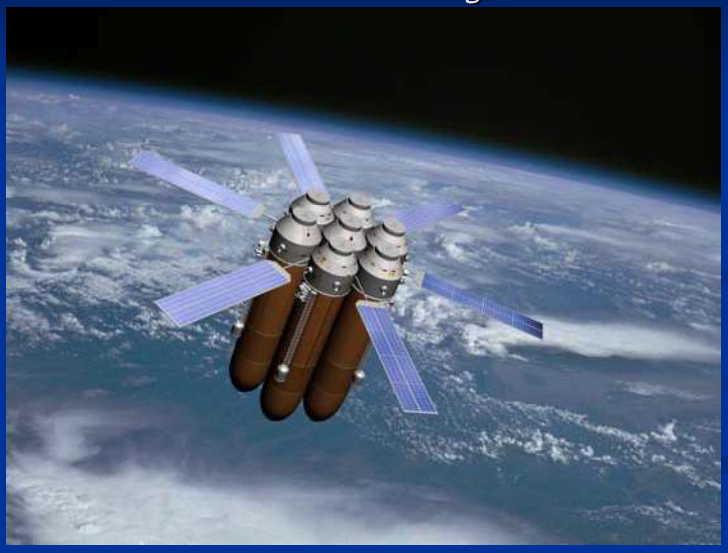
- On some launches the interior of the shorter, side-mounted tank shell will be fabricated as living quarters and labs before launch, just as was done with Skylab
- Hatches will be built between these living quarters and the larger, fuel-filled tank before launch to simplify conversion of the larger interior in orbit

Tank With Labs Built Into Interior Before Launch



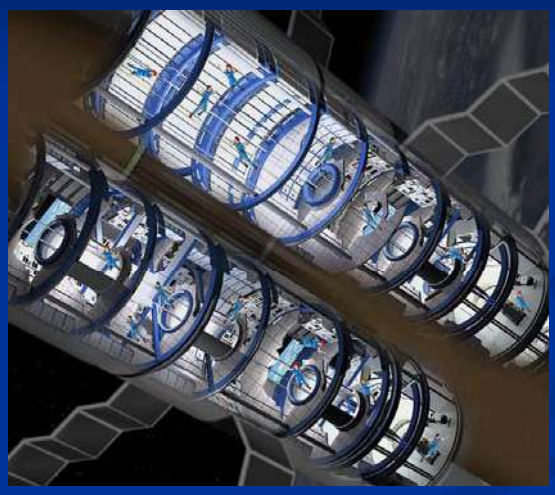
Multi-Tank Commercial Facility

Research, Manufacturing, Tourism



Multi-Tank Commercial Facility

Multi-Use Space Station



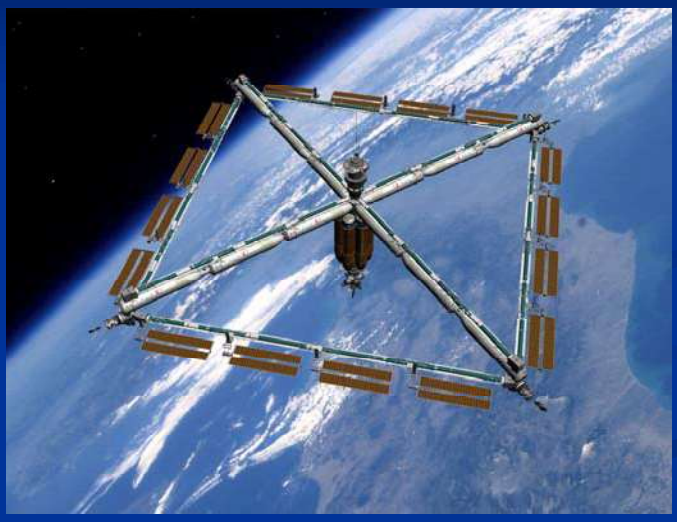
Multi-Tank Commercial Facility

Satellite Repair & Manufacturing

Space Island Partial Gravity Stations

- By 2015 SIG will begin assembling habitable tanks into rotating stations
- An "X Shaped" design will have gravity levels varying from zero-gravity to 1G at the tip of the arms
- The wheel-shaped design will have a 1/3-gravity level in living quarters in the rim of the wheel

Variable Gravity Research Station



Wheel Shaped ,One-Third Gravity Station

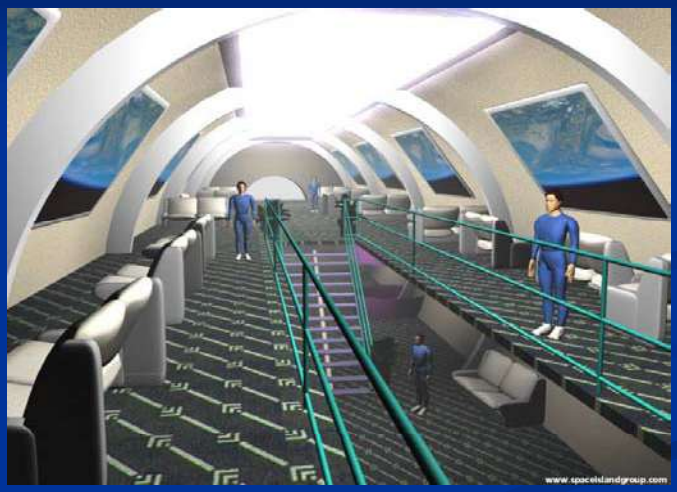
Variable & 1/3-Gravity Ring Stations

- The partial gravity aboard the 500 person, wheel shaped stations will provide healthier and more comfortable living conditions for long-term occupants
- It will also allow the large-scale growth of plants, fish and even poultry for tenant food
- The on-board plants will support a closed loop air and water recycling system

Guest Suite Onboard Rotating Station

Observation Areas

Video Screens Connected To Outside Cameras



Hydroponic & Aquaculture On Ring Stations

Station Facts & Lease Rates

- The combined interior volume of each launcher's large and shorter tanks will total 150,000 cubic feet
- SIG will lease half of these interiors to a wide range of tenants
- The lease rate will be $25,000 per day for a 10-foot by 10-foot by 10-foot compartment outfitted to the tenant's needs
- SIG will retain the other 50% to house their own onboard crews, command and control and life support uses
- SIG has identified markets for at least 3,000 of these converted tanks in orbit

Station Tenant Information

- SIG estimates the cost of each cargo-only launch will be approximately $300 million
- Launches containing the pre-fabricated labs, manufacturing facilities and living quarters will cost approximately $500 million each
- The above lease rates will recover all launch costs within 1 year, eliminating the need to recover these costs from cargo carried to orbit or back to Earth
- This business model allows SIG to carry solar satellite components, tenants and station supplies to orbit and back (via manned and unmanned versions of the DC-X at no charge)

Space Based Solar Satellites

Solar Satellite Cargo Launch Considerations

- Aerospace suppliers agree that SIG's solar satellite weight goal of 3 pounds per kilowatt and their cost goal of $3,000 per kilowatt is achievable with SIG's $1billion investment
- But launching that material to GEO at today's rate of $10,000 per pound has been the single cost hurdle for profitable solar satellite operations
- SIG's business model overcomes this hurdle by transferring that cost to their station tenants

Space Island Group's

Solar Satellite Project Development Timeline

- SIG expects to sign the $200 billion energy purchase agreement by late 2007
- The $10 billion advance should be available in late 2007 or early 2008
- SIG is also negotiating advance station leases, station broadcast rights, station corporate naming rights and other revenues that could total $5 billion by early 2008
- By using streamlined, private sector contracting procedures to purchase its launch components from existing contractors and by building its own dedicated launch facilities at or near Cape Canaveral, SIG believes its first launch could take place by 2011
- SIG estimates that its 2015 revenues will be $50 billion, allowing it to fund the development of a 1 million pound launcher with "habitable" tanks
- SIG's annual revenues are projected to reach $100 billion by 2020 and $200 billion by 2030

Space Island Group, Inc.

Developers of Commercial Space Facilities

www.spaceislandgroup.com